CLAIMS

1. (Amended) An information coding apparatus comprising a code block conversion unit which codes information bits which are inputted as a block of a two-dimensional image made up from m (where m is a natural number) x n (where n is a natural number) pixels,

5   wherein the code block conversion unit arranges pixels which represent the information bits in a code area, which is an area of (m - o) x (n - p) pixels within a code block of m x n pixels (where o and p are natural numbers which satisfy 0<o<m and 0<p<n); and arranges no pixels which represent the information bits in a guide area, which is an area other than the code area within the code block of m x n pixels.

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2. (Amended) An information coding apparatus comprising a code block conversion unit which codes information bits which are inputted as a block of a two-dimensional image made up from m (where m is a natural number) x n (where n is a natural number) pixels,

          wherein the code block conversion unit arranges pixels which represent the

15   information bits in a code area, which is an area of (m - o) x (n - p) pixels within a code block of m x n pixels (where o and p are natural numbers which satisfy 0<o<m and 0<p<n); and arranges pixels which represent predetermined information bits in a guide area, which is an area other than the code area within the code block of m x n pixels.

20   3. (Amended) An information coding apparatus as described in Claim 1 or Claim 2, wherein the code block conversion unit determines the size and the position of a pixel representing the information bits which is arranged in the code area which is the area of (m - o) x (n - p) pixels, based upon the size of the code area, so that the pixel which represents the information bits is completely included in the code area.

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4. (Amended) An information decoding apparatus comprising:

a code pattern estimation unit which receives input of a photographed image which has been obtained by photographing a two-dimensional image which consists of an area of m x n pixels with an imaging device, in which a single code block comprises a code area in which (m - o) x (n - p) pixels which represent information bits (where m and n are natural numbers, and o and p are natural numbers which satisfy $0<o<m$ and $0<p<n$) are arranged, and a guide area in which no pixels which represent the information bits are arranged, and which estimates a code pattern of the code block based upon the result of relative comparison between the photographed image and ideal photographed images which are calculated based upon the positional relationship between the two-dimensional image and the imaging device; and

a bit string reconstruction unit which decodes the information bits corresponding to each code block of the photographed image which is inputted based upon the result of the estimation of the code pattern.

5. (Amended) An information decoding apparatus as described in Claim 4, further comprising:

a positional deviation amount detection unit which detects an amount of positional deviation between pixels of the two-dimensional image and pixels of the imaging device, based upon the photographed image which has been photographed by the imaging device;

an ideal photographed image calculation unit which calculates ideal photographed images of code blocks which are photographed by the imaging device corresponding to all the code patterns based upon the amount of positional deviation which has been detected; and

an image comparison unit which compares together the photographed image

which is inputted and the ideal photographed images which have been calculated, and

calculates relative values, and

wherein the code pattern estimation unit estimates the code pattern of the code

5   block from the relative values which have been calculated.

6. (Amended) An information decoding apparatus as described in Claim 4, further

comprising:

a positional deviation amount detection unit which detects an amount of

10   positional deviation between pixels of the two-dimensional image and pixels of the

imaging device, based upon the photographed image which has been photographed by

the imaging device;

an ideal photographed image calculation unit which calculates ideal

photographed images of code blocks which are photographed by the imaging device

15   corresponding to all the code patterns based upon the amount of positional deviation

which has been detected;

an ideal reconstructed image calculation unit which calculates ideal

reconstructed images of code blocks corresponding to all the code patterns based upon

the ideal photographed images which have been calculated, and the amount of positional

20   deviation which has been detected;

a reconstructed image calculation unit which calculates a reconstructed image of

the two-dimensional image from the photographed image, based upon the amount of

·positional deviation which has been detected; and

an image comparison unit which compares together the reconstructed image

25   which has been calculated from the photographed image and the ideal reconstructed

images which have been calculated from the code blocks, and calculates relative values, and

wherein the code pattern estimation unit estimates the code pattern of the code block from the relative values which have been calculated.

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7. (Amended) An information coding method which codes information bits which are inputted as a block of a two-dimensional image made up from m (where m is a natural number) x n (where n is a natural number) pixels, the method comprising the steps of:

arranging pixels which represent the information bits in a code area, which is an

10   area of (m - o) x (n - p) pixels within a code block of m x n pixels (where o and p are natural numbers which satisfy 0<o<m and 0<p<n); and

arranging no pixels which represent the information bits in a guide area, which is an area other than the code area within the code block of m x n pixels.

15   8. (Amended) An information coding method which codes information bits which are inputted as a block of a two-dimensional image made up from m (where m is a natural number) x n (where n is a natural number) pixels, the method comprising the steps of:

arranging pixels which represent the information bits in a code area, which is an area of (m - o) x (n - p) pixels within a code block of m x n pixels (where o and p are

20   natural numbers which satisfy 0<o<m and 0<p<n); and

arranging pixels which represent predetermined information bits in a guide area, which is an area other than the code area within the code block of m x n pixels.

9. (Amended) An information coding method as described in Claim 7 or Claim 8,

25   wherein the size and the position of a pixel representing the information bits which is

arranged in the code area which is the area of (m - o) x (n - p) pixels are determined

based upon the size of the code area, so that the pixel which represents the information

bits is completely included in the code area.

5   10. (Amended) An information decoding method comprising the steps of:

receiving input of a photographed image which has been obtained by

photographing a two-dimensional image which consists of an area of m x n pixels with

an imaging device, in which a single code block comprises a code area in which (m - o) x

(n - p) pixels which represent information bits (where m and n are natural numbers, and o

10   and p are natural numbers which satisfy 0<o<m and 0<p<n) are arranged, and a guide

area in which no pixels which represent the information bits are arranged;

estimating a code pattern of the code block based upon the result of relative

comparison between the photographed image and ideal photographed images which are

calculated based upon the positional relationship between the two-dimensional image and

15   the imaging device; and

decoding the information bits corresponding to each code block of the

photographed image which is inputted based upon the result of the estimation of the code

pattern.

20   11. (Amended) An information decoding method as described in Claim 10, further

comprising the steps of:

detecting an amount of positional deviation between pixels of the two-

dimensional image and pixels of the imaging device, based upon the photographed image

which has been photographed by the imaging device;

25   calculating ideal photographed images of code blocks which are photographed

by the imaging device corresponding to all the code patterns based upon the amount of positional deviation which has been detected;

comparing together the photographed image which is inputted and the ideal photographed images which have been calculated, and calculating relative values; and

5   estimating the code pattern of the code block from the relative values which have been calculated.

12. (Amended) An information decoding method as described in Claim 10, further comprising the steps of:

10   detecting an amount of positional deviation between pixels of the two-dimensional image and pixels of the imaging device, based upon the photographed image which has been photographed by the imaging device;

calculating ideal photographed images of code blocks which are photographed by the imaging device corresponding to all the code patterns based upon the amount of

15   positional deviation which has been detected;

calculating ideal reconstructed images of all the code blocks corresponding to all the code patterns based upon the ideal photographed images which have been calculated, and the amount of positional deviation which has been detected;

calculating a reconstructed image of the two-dimensional image from the

20   photographed image based upon the amount of positional deviation which has been detected;

comparing together the reconstructed image which has been calculated from the photographed image and the ideal reconstructed images which have been calculated from the code blocks, and calculating relative values; and

25   estimating the code pattern of the code block from the relative values which

have been calculated.

13. (Amended) An information coding program which causes a computer to execute a coding process of coding information bits which are inputted as a block of a two-

5   dimensional image made up from m (where m is a natural number) x n (where n is a natural number) pixels, the coding process comprising the steps of:

arranging pixels which represent the information bits in a code area, which is an area of (m - o) x (n - p) pixels within a code block of m x n pixels (where o and p are natural numbers which satisfy 0<o<m and 0<p<n); and

10   arranging no pixels which represent the information bits in a guide area, which is an area other than the code area within the code block of m x n pixels.

14. (Amended) An information coding program which causes a computer to execute a coding process of coding information bits which are inputted as a block of a two-

15   dimensional image made up from m (where m is a natural number) x n (where n is a natural number) pixels, the coding process comprising the steps of:

arranging pixels which represent the information bits in a code area, which is an area of (m - o) x (n - p) pixels within a code block of m x n pixels (where o and p are natural numbers which satisfy 0<o<m and 0<p<n); and

20   arranging pixels which represent predetermined information bits in a guide area, which is an area other than the code area within the code block of m x n pixels.

15. (Amended) An information coding program as described in Claim 13 or Claim 14, wherein, in the coding process, the size and the position of a pixel representing the

25   information bits which is arranged in the code area which is the area of (m - o) x (n - p)

pixels are determined based upon the size of the code area, so that the pixel which

represents the information bits is completely included in the code area.

16. (Amended) An information decoding program which causes a computer to execute:

5   a process of receiving input of a photographed image which has been obtained

by photographing a two-dimensional image which consists of an area of m x n pixels

with an imaging device, in which a single code block comprises a code area in which (m

- o) x (n - p) pixels which represent information bits (where m and n are natural numbers,

and o and p are natural numbers which satisfy 0<o<m and 0<p<n) are arranged, and a

10   guide area in which no pixels which represent the information bits are arranged, and of

estimating a pattern of the code block based upon the result of relative comparison

between the photographed image and ideal photographed images which are calculated

based upon the positional relationship between the two-dimensional image and the

imaging device; and

15   a process of decoding the information bits corresponding to each code block of

the photographed image which is inputted based upon the result of the estimation of the

code pattern.

17. (Amended) An information decoding program as described in Claim 16, which

20   causes the computer to execute:

          a process of detecting an amount of positional deviation between pixels of the

two-dimensional image and pixels of the imaging device, based upon the photographed

image which has been photographed by the imaging device;

          a process of calculating ideal photographed images of code blocks which are

25   photographed by the imaging device corresponding to all the code patterns based upon

the amount of positional deviation which has been detected;

a process of comparing together the photographed image which is inputted and the ideal photographed images which have been calculated, and calculating relative values; and

5   a process of estimating the code pattern of the code block from the relative values which have been calculated.

18. (Amended) An information decoding program as described in Claim 16, which causes the computer to execute:

10   a process of detecting an amount of positional deviation between pixels of the two-dimensional image and pixels of the imaging device, based upon the photographed image which has been photographed by the imaging device;

a process of calculating ideal photographed images of code blocks which are photographed by the imaging device corresponding to code patterns based upon the

15   amount of positional deviation which has been detected;

a process of calculating ideal reconstructed images of code blocks corresponding to all the code patterns based upon the ideal photographed images which have been calculated, and the amount of positional deviation which has been detected;

a process of calculating a reconstructed image of the two-dimensional image

20   from the photographed image based upon the amount of positional deviation which has been detected;

a process of comparing together the reconstructed image which has been calculated from the photographed image and the ideal reconstructed images which have been calculated from the code blocks, and calculating relative values; and

25   a process of estimating the code pattern of the code block from the relative

values which have been calculated.